Barriers and facilitators to exercise participation in people with hip and/or knee osteoarthritis: synthesis of the literature using behaviour change theory.

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Competing interests:

The authors declare that they have no competing interests.

Author's Contribution

FD, KLB, RSH and SDF conceived the study question. FD led the search, data extraction and initial mapping stages. RK and PJN were the independent study screeners and conducted data extraction and mapping. MAH, SDF and LA led the mapping of each factor to the domains of the framework. All authors reached consensus and approved the final mapping of factors to the framework. All authors contributed to preparation of the manuscript and read and approved the final manuscript.

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Abstract

Exercise is recommended for hip and knee osteoarthritis (OA). Patient initiation of, and adherence to exercise is key to the success of managing symptoms. This study aimed to i) identify modifiable barriers and facilitators to participation in intentional exercise in hip and/or knee OA and; ii) synthesise findings using behaviour change theory. A scoping review with systematic searches was conducted through March 2015. Two reviewers screened studies for eligibility. Barriers and facilitators were extracted and synthesised according to the Theoretical Domains Framework (TDF) by two independent reviewers. Twenty-three studies (total of 4633 participants) were included. The greatest number of unique barriers and facilitators mapped to the *Environmental Context and Resources* domain. Many barriers related to *Beliefs about Consequences* and *Beliefs about Capabilities*, while many facilitators were related to *Reinforcement*. Clinicians should take a proactive role in facilitating exercise uptake and adherence, rather than trusting patients to independently overcome barriers to exercise. Strategies that may be useful include a personalised approach to exercise prescription, considering environmental context and available resources, personalised education about beneficial consequences of exercise and reassurance about exercise capability, and use of reinforcement strategies. Future research should investigate effectiveness of behaviour change interventions that specifically target these factors.

Key words: Osteoarthritis, Exercise, Barriers, Facilitators

Word count: 4545

Introduction

Hip and knee osteoarthritis (OA) are leading causes of disability in older adults worldwide [1]. Exercise is an integral component of non-surgical management of hip and knee OA and is recommended in all published international clinical guidelines [2]. High quality evidence of the benefits of exercise for improving pain and function is well-established in people with knee OA [3] and is mounting in those with hip OA [4]. However, these benefits are dependent on patient's initiation of, and adherence to, exercise [5]. There is a global under-utilisation of exercise in people with OA [6-9] and long-term adherence to exercise for people with OA is poor [10]. In order to facilitate development of effective strategies for people with OA to promote exercise adherence, and thus maximise clinical benefits of exercise for people with OA, identification of factors influencing exercise participation and adherence in people with hip and knee OA is recognised as an important research priority [11].

Several narrative reviews have described a complex array of barriers and facilitators that influence the uptake and maintenance of exercise in people with hip and/or knee OA [12-14]. Factors identified have included those that encompass the physical environment (e.g. weather, access to services), the social environment (e.g. time, supports), personal experiences (e.g. previous exercise history) and individual attributes (e.g. motivation, knowledge, beliefs, attitudes, confidence). Although a number of models have been proposed to assist clinicians and researchers in identifying and assessing barriers and facilitators to exercise in order to design treatments improve exercise adherence [14-17], no study to date has synthesised the barriers and facilitators to exercise using an analytical framework grounded explicitly in theories of behaviour change. Given that long-term exercise adherence usually requires significant behaviour change on the part of individuals with OA, such an approach is needed to drive the development of clinical strategies that are most likely to be effective in increasing exercise participation.

Although strategies to improve exercise participation can be used by health professionals in clinical practice, they are not currently implemented consistently. For example, although UK-based physical therapists report that they monitor exercise adherence in people with knee OA, few use specific strategies such as exercise diaries to encourage exercise adherence [18]. Approximately half do not supervise exercise during the initial treatment session, and very few monitor their patients over the long-term for exercise adherence. Indeed, exercise adherence is viewed by physical therapists as the patient's, not the therapist's, responsibility [19]. Failure of clinicians to recognise the important role they play in facilitating behaviour change in their patients may, at least partially, contribute to the poor adherence to exercise by people with OA. A comprehensive understanding of the modifiable barriers and facilitators to exercise experienced by people with OA, synthesised according to a broad based theoretical framework for behaviour change, is thus needed to inform clinical practice of healthcare professionals recommending and prescribing exercise, and to develop strategies that promote the behaviour change needed in patients for long-term exercise adherence.

The Theoretical Domains Framework (TDF) was developed to simplify and integrate the plethora of behaviour change theories that exist into a single overarching framework [20]. The TDF can be used to assess and explain problems with implementing treatments known to be efficacious and to inform development of strategies designed to improve intervention implementation [20]. The TDF comprises theoretical domains that are considered to influence behaviour and behaviour change. The refined framework integrates 128 explanatory constructs from 33 theories by grouping them into 14 distinct domains [21 22]: *Knowledge, Skills, Social/Professional Role and Identity, Beliefs about Capabilities, Optimism, Beliefs about Consequences, Reinforcement, Intentions, Goals, Memory, Attention and Decision Processes, Environmental Context and Resources, Social Influences, Emotions,* and *Behavioural*

Regulation. Strengths of the TDF include that it incorporates multiple theories of behaviour change, that it provides a useful conceptual basis for understanding behaviour-change processes and that it can be used to guide the choice of appropriate behaviour change techniques to improve implementation of a given intervention [21 23].

The use of the TDF can ensure a comprehensive identification of all possible mediators of behaviour and behaviour change [23]. The TDF provides a useful conceptual basis for analysing implementation problems and subsequently designing implementation interventions to improve healthcare clinical practice. The TDF has been used to explore implementation problems in a number of different clinical areas. For example, the TDF has been used to explore healthcare professional barriers and facilitators in implementing weight management and obesity guidelines in pregnant women [24], and to develop a complex intervention to improve acute low back pain management in primary care [25]. However, no study to date has used the TDF to explore the patient-related barriers and facilitators to exercise participation and adherence.

A scoping study, defined as a method to map key concepts, main sources and available evidence underpinning a research area [26], is an increasingly common approach to reviewing literature [27]. Arksey and O'Malley [26] described a number of reasons for conducting a scoping study, including to examine the extent, range and nature of research activity; to summarise and disseminate research findings; and to identify research gaps in existing literature. As such, a scoping review, guided by the TDF, is an appropriate methodology to provide an overview and analytic framework of barriers and facilitators to exercise participation in people with hip and knee OA. The aims of this scoping review were to: i) identify barriers and facilitators to participation in intentional exercise for people with hip and/or knee osteoarthritis (OA) and; ii) map modifiable barriers and facilitators to the Theoretical Domains Framework (TDF).

Methods

The review was conducted according to the multi-stage framework of scoping reviews as described by Arksey and O'Malley [26]: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies, with the establishment of inclusion/exclusion criteria; (4) charting the data, including sifting, charting, and sorting information according to key issues and themes; and (5) collating, summarising, and reporting the results, including a thematic analysis.

Stage 1: Identifying the research question and operational definitions:

The key research question was: "For people with hip and/or knee osteoarthritis (OA), what are the barriers and facilitators to participation in intentional exercise?" Operational definitions for the key terms in the research question were developed by the authors and are further expanded in the inclusion criteria in Stage 3.

Stage 2: Identifying relevant studies

Electronic searches of databases from inception until March 2015 were performed using MEDLINE (via PubMed), CINAHL and SPORTSDiscus (via EBSCO), and the Cochrane Library (Wiley). Key search terms and synonyms were searched separately in three main filters: i) population terms (hip and knee OA); ii) exercise terms; and iii) barrier and facilitator terms. These were combined with the "AND" operator, without any further restrictions. Supplementary hand searching of references cited in retrieved articles was also conducted. A full search strategy for the MEDLINE database is provided in Appendix 1.

Stage 3: Study selection

The titles and abstracts of all retrieved studies were initially screened by two independent researchers, followed by an independent full-text review of potentially eligible studies by two review authors. Any disagreements from either screening phase were discussed and resolved with a third review author. Studies were included if they met the following criteria:

1. *Population:* participants were people 45 years or older with OA of the hip and/or knee, diagnosed according to the definition of the original study investigators. This included both clinical and radiological diagnoses.
2. *Intentional exercise:* defined according to the World Health Organization definition as the participation (initiation, maintenance and/or adherence) in any physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective [28]. That is, an activity with the *intent* to exercise. The activity could be supervised (e.g. individual or group sessions with a physical therapist or fitness instructor) or unsupervised (e.g. home exercises, walking program), as well as prescribed (e.g. by a health professional), advised (recommended by a website or support group) or self-initiated.
3. *Barriers and facilitators:* any factor, characteristic, view or belief that either impedes or enables participation in exercise.
4. *Study design:* any primary empirical study, including qualitative, quantitative and mixed-method designs, and systematic reviews, that was published as a full paper, and had a primary and/or secondary aim of exploring or evaluating barriers/facilitators to participation in intentional exercise.
5. *Language of publication:* Studies published in English language.

Studies were excluded if: i) participants were not specifically described as having hip or knee OA; ii) >50% of study participants had conditions other than OA, such as systematic or

inflammatory joint conditions, or if hip/knee pain was not clearly attributed to OA (unless a sub-group analysis was provided of the OA participants); iii) the majority of study participants were less than 45 years of age (unless sub-group analysis was provided); iv) the majority of study participants included people with hip and/or knee OA following joint replacement surgery, as barriers and facilitators to exercise for these people may be different; v) there was no exercise component to the intervention evaluated; vi) in the case of multimodal interventions (e.g. physical therapy), the relationship between the barriers/facilitators and the specific exercise component of the intervention was not evaluated; and it was a narrative review.

Stage 4: Charting the data (data extraction)

Characteristics of each eligible study, including details of the participants, study design, type of exercise, and reported barriers and facilitators to exercise participation, were extracted by one author. The extracted barriers and facilitators were checked by a second review author.

Stage 5: Collating, summarising and reporting the results

Each extracted modifiable barrier and facilitator was mapped to the 14 domains of the TDF by two independent review authors and mediated by a third review author in cases of disagreement. All authors subsequently confirmed the mapping of each identified barrier/facilitator to each TDF domain, one of whom is a health psychologist who is an expert in behaviour change. As acknowledged by the developers of the TDF, domains in the framework are not necessarily mutually exclusive and factors may have membership across multiple domains. Accordingly, each barrier and facilitator was mapped to all relevant domains of the TDF.

Results

Description of included studies

Selection of studies is summarized in Figure 1. Twenty-three eligible studies [16 17 29-49] were identified and are described in Table 1. A total of 4633 participants were included in the review, with individual study sample sizes ranging from 11 to 1021 participants. Studies were conducted in the United States of America (6 studies), Australia (5 studies), United Kingdom (4 studies), Canada (2 studies), Netherlands (2 studies), Germany (1 study), Iceland (1 study), Turkey (1 study) and New Zealand (1 study). Fourteen studies included people with both hip and/or knee OA, nine included people with primarily knee OA, while none included people with primarily hip OA. There were 15 quantitative studies, six qualitative studies and two mixed-methods studies.

Types of exercise

A range of exercise programs were focused on in the included studies: aerobic activity [29 30 33 35 37-41 45], strengthening exercise [16 31 39 41 43 47 48], flexibility exercise [31], range of motion exercise [37], or a combination of strengthening, flexibility and endurance exercises [44 46 49]. The exercise type was not specified in three studies [34,36,42.] Eleven studies evaluated structured, supervised, exercise programs that were prescribed by a health professional [16 30 31 37-39 43-45 47 48] and three studies addressed exercise programs that had been advised by a health professional but were performed mostly unsupervised [29 33 41]. Six studies evaluated exercise that had been self-initiated by the participants [17 32 35 36 40 42 49] and a further two studies addressed a mixture of prescribed, advised and self-initiated exercise programs [34 46].

Barriers and facilitators to exercise participation

Barriers and facilitators to exercise identified by each of the included studies are described in Table 1. These mapped across all 14 domains of the TDF (Table 2). Many modifiable barriers

related to the domains of *Environmental Context and Resources* and *Beliefs about Consequences,* while many facilitators were mapped to *Environmental Context and Resources* as well as *Reinforcement*. A small number of the barriers and facilitators identified in the selected studies were non-modifiable. Non-modifiable barriers included low educational level [40], older age [35 36 40], history of poor exercise adherence [37] and being a long-term sedentary person [35 43 46]. Non-modifiable facilitators included increased OA disease duration [44], being a long-term active person [36], being male and having a higher education level [48]. A summary of the most common types of modifiable barriers and facilitators in each TDF domain follows.

i. Knowledge: an awareness of the existence of something

Lack of knowledge and/or education about OA and/or lack of adequate instructions about exercise and its benefits were identified as barriers, whereas education and/or knowledge about OA and/or clinicians demonstrating exercises were reported as facilitators.

ii. Skills: an ability or proficiency acquired through practice.

No barriers mapped to the skills domain. Prior experience with exercising was a facilitator.

iii. Social/Professional Role and Identity: a coherent set of behaviours and displayed personal qualities of an individual in a social setting

Poor self-image or the self-perception of being inactive were viewed as exercise barriers, whereas a positive self-image and feelings of being able to contribute to a study/program were considered to be facilitators.

iv. Beliefs about Capabilities: acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use

Seven different studies identified barriers to exercise related to this domain [16 17 34-36 40 41 48], primarily focused on negative beliefs about the severity of symptoms (eg pain, stiffness, fatigue and disability) adversely impacting capability to exercise. Believing that excess weight and the presence of comorbidities leads to a perceived inability to exercise were also barriers.

Exercise facilitators for this domain included perceptions of being physically active, of having low levels of physical limitation and positive beliefs about taking control of disability.

v. Optimism: the confidence that things will happen for the best or that desired goals will be attained

Fatalism regarding OA and a negative attitude to exercise were barriers to exercise while positive health and exercise attitudes were regarded as facilitators across four studies [16 17 36 45].

vi. Beliefs about Consequences: acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation

Eight different studies identified barriers to exercise that were related to patient beliefs about the consequences of exercise [16 17 30 35 36 40 44 46]. Barriers centred around perceptions that exercise has limited effectiveness for OA and/or that exercise would result in negative consequences such as increased pain or other symptoms. Similarly, positive expectations about exercise effects were facilitators to exercise.

vii. Reinforcement: increasing the probability of a response by arranging a dependent relationship between the response and a given stimulus

While only three studies identified lack of reinforcement as a barrier to exercise [16 17 35], nine different studies identified a range of factors related to positive reinforcement that were facilitators to exercise participation, including use of incentives, pain improvement and encouragement from medical practitioners [17 31 32 35-37 44 48 49].

viii. Intentions: a conscious decision to perform a behaviour or a resolve to act in a certain way

Lack of motivation, laziness and self-belief about being sufficiently active were all barriers to exercise participation, whereas strong motivation, determination, initiative and loyalty to therapists were all reported to be facilitators.

ix. Goals: mental representations of outcomes or end states that an individual wants to achieve

Goal setting emerged as being important to exercise participation across four different studies [30 31 38 45] with lack of goal setting being a barrier and use of long and short-term goals being a facilitator.

x. *Memory, Attention and Decision Processes: the ability to retain information, focus selectively on aspects of the environment and choose between alternatives*

Tiredness, forgetfulness and inactive habits were barriers to exercise in this domain of the TDF, whereas good sleep, previous exercise adherence and being physically active were facilitators. Lack of patient input into the exercise program was a barrier to participation while active involvement of the patient in the content of the intervention was a facilitator.

xi. *Environmental Context and Resources: any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour*

Twelve of the 23 included studies (52%) identified factors related to environmental context and resources as either barriers and/or facilitators to exercise. Barriers included poor weather conditions, access to facilities, use of a walking aid, hills/stairs during walking programs, costs of exercise, safety concerns, transport and parking, whereas good weather conditions and easy access to suitable, low-cost classes were regarded as facilitators.

xii. *Social influences: those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours*

Family commitments, lack of family/social support and lack of a training partner were all regarded as barriers to exercise. Increased family/social support and exercising with a partner were most commonly viewed as facilitators in this domain of the TDF.

xiii. *Emotions: a complex reaction pattern by which an individual attempts to deal with a personally significant matter or event*

Anxiety, boredom and lack of enjoyment were emotional barriers to exercise, while enjoyment and improved depression with exercise were facilitators.

xiv. Behavioural Regulation: anything aimed at managing or changing objectively observed or measured actions

Although no study identified any barriers to exercise in the behavioural regulation domain of the TDF, a range of facilitators were identified including performing exercise at one's own pace, prioritisation and integration of exercise into daily lifestyle and ongoing monitoring.

Discussion

This review utilised a systematic approach to identify the previously published barriers and facilitators that people with hip and/or knee OA encounter when participating in intentional exercise, and mapped these barriers and facilitators to the theoretical domains of the TDF. Many barriers were mapped to *Environmental Context and Resources* and *Beliefs about Consequences* whereas many facilitators were mapped to *Environmental Context and Resources* and *Reinforcement.* These results provide a useful basis for clinicians to better assist their patients with OA to change their behaviour towards long-term exercise adherence, and to guide the development and evaluation of strategies designed to increase adherence to exercise in people with hip and/or knee OA. This review has highlighted that people with hip and/or knee OA are faced with a wide and complex variety of barriers and facilitators to exercise participation. The complex, and often inter-related, nature of factors influencing exercise participation means that a single approach to promoting exercise participation is unlikely to be effective across all people with hip and/or knee OA, or across all points of the disease trajectory in a given individual patient. Nonetheless, our study has highlighted the TDF domains most commonly represented by barriers and facilitators. Research to evaluate whether interventions that targets these domains improve outcomes in people with hip and/or knee OA is now required.

Our findings highlight the importance of environmental context and available resources in influencing participation and adherence to exercise. When prescribing or recommending exercise for a person with hip/knee OA, our results suggest that clinicians should consider the circumstances of each individual's situation and environment, and identify barriers that may impede exercise participation and ongoing adherence. To do so, clinicians would be advised to engage in a meaningful discussion with patients about their preferences for exercise, including their ability and willingness to access facilities (considering both transportation and cost). Clinicians should also take an active role in assisting their patients to determine the most appropriate exercise program for their individual circumstances, and not trust that a patient can successfully navigate their own way towards following generic and non-personalised advice to exercise. Research into UK-based physiotherapists attitudes to exercise shows less than 50% of therapists believe the patient is the best person to decide if they should do their exercises at home or in a group setting [19], suggesting that many clinicians are not using a person-centred approach to exercise management and that this could be contributing to poor exercise adherence in people with OA. Our findings show that patient beliefs, about their capabilities for, and the consequences of, exercise are important barriers to exercise for people with OA. Given that research has shown that older adults with knee pain have considerable uncertainty about the benefits of exercise for knee pain [36], clinicians must make concerted efforts to educate their patients regarding exercise benefits, prior to prescribing an exercise program. Presence of x-ray changes appears to be an important factor influencing a person's belief about exercise effectiveness [36]- approximately 40% of people believe exercise is effective in the presence of mild radiographic OA and this drops to around 20% with respect to severe OA. For patients with radiographic changes of OA, clinicians should emphasise that such individuals are capable of exercise and are also likely to experience benefits of exercise, irrespective of x-ray findings. Fear of causing increased pain or further joint damage, and beliefs that exercise is beyond one's capabilities or will not provide benefit, stems from lack of knowledge [36].

Clinicians play a crucial role in providing accurate information about OA and the role of exercise. However, given that only 56% of physical therapists largely/totally agree that exercise is effective for knee OA [19], it seems that education directed to clinicians is also required to ensure that patients are given accurate, unbiased and evidence-based information. Our review shows reinforcement plays a major role in facilitating participation and adherence to exercise. Although allied health clinicians, such as physiotherapists, are traditionally responsible for exercise prescription for people with OA, encouragement and endorsement from doctors is also important [17 32 35]. This reinforces the need for a multi-disciplinary team-based approach to OA management where medical practitioners actively endorse and support non-pharmacological approaches to OA. Our findings also highlight that internal reinforcement mechanisms are important facilitators to exercise; people who notice improvements in symptoms with exercise are more likely to continue exercising. This could be achieved by patients via simple self-reported pain scales and exercise log books which could help reinforce the benefits of exercise by increasing self-awareness of symptom changes over time. Only 57% of physiotherapists report using self-reported measures of pain and function to monitor progress with exercises, and only 12% instruct their patients in the use of exercise diaries [18], which highlights areas of clinical practice that could be changed in order to improve exercise adherence in people with OA.

This is the first review we are aware of to map the barriers and facilitators to exercise participation for people with hip and/or knee OA to the domains of the TDF. Our findings provide a useful basis to develop new strategies that may help increase long-term adherence to exercise in people with hip/knee OA, and thus ultimately optimise the clinical benefits of exercise in this patient group. In development, the TDF was informed by theoretical constructs of behaviour change and thus domains within this framework can be theoretically linked to interventions of behaviour change [21]. Michie et al [21] suggested three main reasons for using

theory in designing behaviour change interventions. First, interventions are likely to be more effective if they target the theoretical mechanisms of change. Second, theory can be tested and developed by evaluations of interventions only if those interventions and evaluations are theoretically informed. Third, theory-based interventions facilitate an understanding of what works and thus are a basis for developing better theory across different contexts, populations, and behaviours. Our review has highlighted many barriers and facilitators to exercise participation in the *Environmental Context and Resources, Beliefs about Consequences* and *Reinforcemen*t domains of the TDF, thus behaviour change techniques associated with these domains warrant further consideration and future research efforts. Future research should evaluate the effects of explicit behaviour change strategies on exercise and participation and adherence in people with OA.

Strengths of this scoping review included the use of a theoretically-informed systematic approach to identify and synthesise the findings of relevant qualitative and quantitative research. The TDF is arguably one of the most comprehensive frameworks for systematically identifying moderators of behaviour [25]. Using a broad theoretical framework, as opposed to a single theory, enabled a more encompassing examination of potential barriers and facilitators. The synthesis of findings in this scoping review adds to existing reviews and models by providing a framework grounded explicitly in theories of behaviour change. Further, the inclusion of findings from qualitative study designs helps to add depth of understanding, which is useful for describing complex phenomena such as exercise participation. A potential limitation of this review is, as acknowledged by the developers of the TDF, that domains in the framework are not mutually exclusive, meaning that some barriers and facilitators can be mapped across multiple domains. This means that multiple behavioural change strategies may be required to address factors related to exercise participation in people with OA. Another important limitation is that, unlike a systematic review, this scoping review did not incorporate

a risk of bias assessment of included studies and identified barriers and facilitators were mapped to the TDF regardless of the methodological quality of the originating study. As the purpose of a scoping review is to map the body of literature and present a broad scope overview of a diverse body of literature [26], it has been argued that scoping reviews should include all relevant literature regardless of methodological quality, given that their intent is to present an overview of the existing literature in a field of interest [50]. Further, scoping reviews are more commonly used for hypothesis generation and the stimulation of future research[50], rather the synthesis of new evidence from high quality studies as in a systematic review. Future research should include a systematic review of the efficacy of interventions for overcoming barriers to exercise using evidence from high quality studies. The identified barriers and facilitators in this review were derived from quantitative, qualitative and mixed designs, hence estimates of the strength and precision of relationships was not appropriate for many factors. Significant results derived from quantitative studies were mapped to the TDF regardless of the strength and precision of relationships found in these studies. Finally, we did not identify any studies from Asia, Africa or South America. It is acknowledged that cultural differences can influence exercise participation, particularly to practitioner-prescribed interventions [12] and this may influence the generalizability of our results. More primary research is required to identify culturally-specific barriers and facilitators in these populations.

Many modifiable barriers and facilitators to intentional exercise are related to the circumstances of a person's situation or environment that either discourages or encourages the development of exercise skills and abilities, independence, social competence and adaptive behaviour. Negative beliefs about the consequences of exercise are also barriers. Clinicians advising exercise for people with OA should take a personalised approach that considers the environmental context and resources available to the individual, as well as educate patients regarding the beneficial effects of exercise, in order to maximise exercise participation and

adherence. Use of reinforcement strategies should be considered to promote exercise adherence. Future research is required to investigate the effectiveness of behaviour change interventions that specifically target these barriers and facilitators to exercise.

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List of Tables

Figure Legends

Figure 1. Flow diagram of study selection processes.

Appendices

Appendix 1. Full search strategy in MEDLINE (PubMed)